

Low-temperature hydrogen peroxide gas plasma--a sterilization process useful in space exploration technology<sup>†</sup>.

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Current planetary protection methods for various missions include wiping or cleaning hardware with alcohol and then bioassaying the surfaces. For hard to clean surfaces, a dry heat process is used to reduce the microbial burden. The disadvantages of the dry heat process are the high temperatures involved (105 to 125°C) and long processing time (5 to 50 hours). The hydrogen peroxide plasma sterilization process involves low process temperatures (50 to 55°C) and short process time (approximately one hour). Some common spacecraft materials tested to-date include metals, plastics, adhesives, tapes, lubricants, circuit board coatings, paints, thermal blankets, and miscellaneous hardware components. A list of materials and their properties before and after exposure to hydrogen peroxide will be presented. The results show good compatibility with spacecraft hardware tested and that the hydrogen peroxide plasma process shows great promise as an alternative spacecraft hardware sterilization technique. Representatives of Gram-positive and Gram-negative bacterial species procured from American Type Culture Collection were artificially seeded onto aluminum coupons and subjected to hydrogen peroxide sterilization. Conventional culture techniques revealed that all the tested bacterial species were killed by 2 to 4-injections of hydrogen peroxide treatments. The hydrogen peroxide-treated coupons analyzed *in situ* by environmental scanning electron microscopy revealed remnants for all microbes tested. The microbial structure of the Gram-positives was intact when compared to the Gram-negatives. However, these samples did not yield any PCR-amplifiable 16S rDNA fragments. Likewise, microbial species isolated from Jet Propulsion Laboratory Spacecraft Assembly Facility were subjected to various doses of hydrogen peroxide treatment to determine their sensitivity.

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